REMARKS

By this amendment, claims 1-5 have been amended, and claims 8-17 have been added. Thus, claims 1-17 are now active in the application. Reexamination and reconsideration of the application are respectfully requested.

The specification and abstract have been carefully reviewed and revised to make grammatical and idiomatic improvements in order to aid the Examiner in further consideration of the application. The amendments to the specification and abstract are incorporated in the attached substitute specification and abstract. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the specification and Abstract by the current amendment. The attachment is captioned "**Version with markings to show changes made**."

In item 2 on page 2 of the Office Action, Fig. 2 was objected to for failing to show vent hole 49 as illustrated in Fig. 1 and described in the specification. Accordingly, a replacement Fig. 2 is submitted herewith, and this replacement Fig. 2 shows the vent hole 49 that is also illustrated in Fig. 1 and described in the specification. It is respectfully requested that the Examiner approve this replacement drawing, and indicate such approval in the next Office Action.

In item 3 on page 3 of the Office Action, lines 5-7 of page 10 of the specification were objected to for being misdescriptive. Accordingly, the above-mentioned substitute specification is effective to change "Pumps 48A, 48B are functionally independent. The pumps are communicated with each other via communicating sections 47A, 47B and paths 45A, 45B" to --Pumps 48A, 48B are functionally independent. The pumps are communicated with paths 45A, 45B via communicating sections 47A, 47B--.

In item 4 on pages 3 and 4 of the Office Action, claims 1-3 and 5 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for inconsistent use of the term "communicates." Accordingly, the term "communicates" has been deleted from the claims.

In items 6-12 on pages 4-12 of the Office Action, claims 1-4, 6 and 7 were rejected under 35 U.S.C. 103(a) as being unpatentable over Goodnight (U.S. 6,457,561) in view of Khoo et al. (U.S. 5,842,420); and claim 5 was rejected under 35 U.S.C. 103(a) as being unpatentable over Goodnight and Khoo et al. and further in view of Andrione et al. (U.S. 4,478,559). These rejections are respectfully traversed and are believed clearly inapplicable to the present claims, for the following reasons.

With exemplary reference to the drawing figures, claim 1 sets forth a reciprocating compressor comprising: a motor unit 21; a compressing unit 22 disposed over the motor unit 21 and including a compression chamber 38; a piston 32 disposed for reciprocation in the compression chamber 28, and a crankshaft 24 for converting rotating action of the motor unit 21 into reciprocating action of the piston 32. The reciprocating compressor of claim 1 is further required to include an enclosed container 18 accommodating the motor unit 21 and the compressing unit 22 and having a lubricant oil pooling portion (i.e. bottom portion in Fig. 1) for pooling lubricant oil. The crankshaft 24 of claim 1 is required to include a centrifugal pump (e.g. slant path 42) disposed at a lower section of the crankshaft 24 and opening into the lubricant oil pooling portion of the container 18, a pair of spiral pumps 43A, 43B, functionally independent, disposed at a middle section of the crankshaft 24, fluidically connected with the centrifugal pump (e.g. 42), and having leading grooves 43A, 43B running in opposite directions to each other. Claim 1 further requires a pair of vertical holes 45A, 45B, functionally independent, provided at an upper section of the crankshaft 24 and opening into the container 18 and fluidically connected with the spiral pumps 43A, 43B.

Thus, according to claim 13, the reciprocating compressor has a pair of spiral pumps 43A, 43B that are functionally independent of one another, and a pair of vertical holes 45A, 45B that are also functionally independent of one another and that are fluidically connected to the spiral pumps 43A, 43B, respectively. With this arrangement, the lubricant oil sucked up from the lubricant oil pooling portion of the container 18 by the centrifugal pump (e.g. 42) is caused to be pumped upwardly into one of the vertical holes 45A, 45B via one of the spiral pumps 43A, 43B.

The one of the spiral pumps 43A, 43B and the one of the vertical holes through which the lubricating oil is pumped is dependent upon the rotating direction of the crankshaft 24. Because the spiral pumps 43A and 43B are functionally independent of one another, and the vertical holes 45A, 45B are functionally independent of one another, the spiral pump and vertical hole that are not being used for upward pumping of the lubricant oil (i.e. upon rotation of the crankshaft 24 in the particular direction) do not have a negative effect of pumping oil downwardly.

In contrast to the present invention of claim 1, the Goodnight patent discloses spiral pump grooves 42, 44 that are not functionally independent of one another as required by claim 1. That is, in the Goodnight viscous pumping system, the spiral pumps 42 and 44 have substantial fluidic communication with each other due to the presence of a reduced-diameter portion of the crankshaft (see the reduced-diameter portion shown, for example, in Figs. 6-9). The reduced-diameter portion is the section of the shaft to which the reference numeral 46 points in each of Figs. 6 and 8. This reduced-diameter section, and the resultant fluidic communication between the spiral pumps 42 and 44, is also clearly viewable from Fig. 14. In Fig. 14, the reduced-diameter section of the crankshaft is that section shown at the top of Fig. 14 on which the rotational arrow is provided. This fact that the spiral pumps (helical grooves 42, 44) fluidically communicate with each other is acknowledged in the Goodnight patent at, for example, column 5, line 51 - column 6, line 5. In this section of the Goodnight patent, it is described that the "passive" or "negative" groove (i.e. the groove that is not intended to pump liquid upwardly upon rotation of the crankshaft due to the direction of rotation) causes some pumping of lubricant in the direction opposite to the pumping direction of the upwardly-pumping groove. Specifically, it is noted in this section of the Goodnight patent that "the 'active' or 'positive' groove for that particular direction of rotation pumps lubricant contained in the reservoir to the bearing, while the other 'passive' or 'negative' groove either substantially avoids pumping lubricant away from the bearing or pumps only a minimal amount of lubricant away from the bearing relative to the amount pumped to the bearing. By pumping considerably more lubricant to the bearing than it draws out in both a forward and a reverse direction of rotation, such a system ensures that the

bearing is adequately lubricated regardless of the direction of rotation of the shaft." (Underlining added). Thus, the spiral grooves 42, 44 of the Goodnight patent are clearly not functionally independent from one another as required by claim 1.

In addition to the above, and as recognized by the Examiner, the Goodnight patent does not disclose or suggest a pair of functionally independent vertical holes provided at an upper section of the crankshaft, such as required by claim 1. Accordingly, the Examiner cited the Khoo et al. patent for teaching "a single helical groove (spiral pump) that communicates with a centrifugal pump (Khoo et al., Figure 5, Article 64) disposed in the lower section of the crankshaft, and a vertical hole (Khoo et al., Figure 5, Article 72) that is prepared at an upper section of a crankshaft (Khoo et al., Figure 5, Article 75) and open to a container (Khoo et al., Figure 1, Article 12). This disclosure of Khoo et al. of a single helical groove 68 in communication with a single vertical hole 72 is said by the Examiner to be a teaching that, "as applied to Goodnight '561 would provide for each helical groove (Goodnight '561, Figure 8, Articles 42 and 44) to be in communication with a functionally vertical hole."

Thus, it is the Examiner's contention that the showing in the Khoo et al. patent of a crankshaft having a single spiral groove 68 connected to a single vertical hole 72 is a teaching that would have lead a person of ordinary skill in the art to modify the Goodnight patent's arrangement of two spiral grooves 42, 44 to provide two separate and independent vertical holes connected to their upper ends. The Examiner stated

> "[T]he motivation for combining the claimed inventions of Goodnight '561 and Khoo et al. '420 would be ensure that the bearings, in contact with said crankshaft, are always properly and efficiently lubricated by facilitating a constant flow of oil from said reservoir to said bearings, regardless of the rotational direction of an active motor. Therefore it would have been obvious, to one of ordinary skill in the art, to combine Goodnight '561 and Khoo et al. '420, as applied above, to provide a lubrication system for a crankshaft that would perform (lubricate) the same, regardless of which direction the motor, of said compressor, was rotating."

However, it is noted that there is no disclosure or suggestion in either the Goodnight patent or the Khoo et al. patent of providing two functionally independent vertical holes connected to two functionally independent spiral pump, respectively; neither of the Goodnight patent and the Khoo et al. patent discloses two vertical holes such as required by the present claim 1; the motivation that the Examiner has stated for "combining the claimed inventions of Goodnight '561 and Khoo et al. '420" is a motivation taken from Applicant's own disclosure. There is no disclosure or suggestion in either of the Goodnight patent and the Khoo et al. patent that the use of such two functionally independent vertical holes would facilitate the crankshaft lubrication regardless of the rotational direction of the motor.

Thus, for the above reasons, it is believed apparent that the present invention as claimed in claim 1 is not disclosed or suggested in the Goodnight reference, the Khoo et al. reference, or in any combination thereof. Furthermore, the differences are such that a person of ordinary skill in the art would clearly not have been motivated to modify the Goodnight arrangement in view of the Khoo et al. arrangement or to make any combination of the references of record in such a manner as to result in or otherwise render obvious the present invention of claim 1. Therefore, it is respectfully submitted that claim 1, as well as claims 2-12 which depend therefrom, are clearly allowable over the prior art of record.

The Examiner's attention is next directed to the dependent claim 3 which specifies the provision of a vent hole (e.g. vent hole 49 in Fig. 1 of the present application) which is provided at an upper section of the centrifugal pump (e.g. 42) and opens into the container 18. In item 9 on page 7 of the Office Action, the Examiner referred to a vent hole 76 shown in the Khoo et al. patent. However, the hole 76 of Khoo et al. is a bleeding orifice provided for venting air bubbles in the oil (see column 3, lines 52-43). That is, since the bleeding orifice 76 of Khoo et al. is provided at a lower part of a centrifugal pump, gaseous (bubbles) which do not escape through bleeding orifice 76 are sent upwardly, causing interruption of the supply of lubricant to the slide section which bear against the bearing. If the bleeding orifice is enlarged in diameter in order to more-efficiently remove gases, additional lubricant will leak out via the bleeding orifice 76. This

would also cause interruption of supply of the lubricant to the slide sections which slide against the bearing.

In contrast, the vent hole 49 of the present invention is provided at the top end of the centrifugal pump (slant pump 42) for discharging refrigerant gas generated from lubricant oil 23 back into the container 18 (see page 8, lines 20-23 of the present specification). Thus, vent hole 49 can remove gases (bubbles) stored in the centrifugal pump, while preventing interruption of supply of the lubricant to the slide section. In addition, because the vent hole 49 is provided at an upper section of the centrifugal pump, the vertical distance from the oil surface of the oil 23 along the slant pump 42 to the opening of the vent hole 49 is relatively long so that lubricant 23 is prevented from leaking from the vent hole 49. As a result, the amount of lubricant oil supplied to the slide section is improved.

The Examiner's attention is also directed to claim 5 which recites the presence of the helical grooves 48A and 48B as illustrated, for example, in Fig. 2. In particular, claim 5 specifies that a pair of helical grooves 48A, 48B, which are functionally independent, are provided on an outer wall of the sub-shaft section 26 of the crankshaft 24, that the helical grooves 48A, 48B run in opposite directions to each other and are fluidically connected with the pair of vertical holes 45A, 45B, respectively, and that the helical grooves 48A, 48B themselves serve to pump the lubricating oil upwardly.

The Examiner recognized that the Goodnight and Khoo et al. patent do not disclose any such helical grooves as required by claim 5 and, accordingly, cited the Andrione patent for disclosing a groove 72 that, according to the Examiner, would make it obvious to modify the Goodnight and Khoo et al. combination to "provide two vertical holes open to container of said compressor displaced on top said crankshaft, also known as a sub-shaft (Andrione et al. '559, Figure 1, Article 68 of Article 66) in the claimed invention." Figs. 2 and 3 of Andrione show the groove 72, and it is noted that the groove 72 extends diametrically across the upper end portion 66 of a sub-shaft section, and does not in any way suggest the use of helical grooves. The groove 72 of Andrione is provided for spraying the lubricant sent to the upper end portion 66 into a

space in the hermetic container. The groove 72 does not act as a pump to pump lubricant upwardly, and clearly does not constitute functionally independent helical grooves provided on an outer wall of the sub-shaft section.

In contrast, the grooves 48A and 48B of the present invention are provided on the outer wall of the sub-shaft section and are helical grooves. They are effective to supply lubricant oil 23 to the slide sections around sub bearing 30 and to serve as pumps.

Accordingly, the groove 72 of the Andrione et al. patent clearly does not constitute the claimed helical groove that serves as a pump for pumping lubricant upwardly, nor a pair of helical grooves such as specifically recited in claim 5.

Next, with exemplary reference to the drawing figures, new independent claim 13 sets forth a reciprocating compressor comprising: an enclosed container 18 having a lubricant oil pooling portion to allow for pooling of lubricant oil 23 therein; a motor unit 21 disposed in the container 18; a compressing unit 22 disposed in the container 18 over the motor unit 21 and being arranged to be driven by the motor unit 21; wherein the compressing unit 22 includes a cylinder block 29, a compression chamber 28 formed in the cylinder block 29, a piston 32 disposed for reciprocation in the compression chamber 28, and a crankshaft 24 operably coupled to the piston 32 and the motor unit 21 to cause reciprocation of the piston 32 upon rotating action of the motor unit 21; wherein the crankshaft 24 includes a lower, main section 27 coupled with the motor unit 21, a middle, eccentric section 25 disposed above the main section 27 and coupled to the piston 32, and an upper, sub-shaft section 26 disposed above the eccentric section 25; wherein a lower, main bearing 31 is provided about the main section 27 of the crankshaft 24 to rotatably support the crankshaft 24 at the main section 27 thereof; wherein an upper, sub bearing 30 is provided about the sub-shaft section 26 of the crankshaft 24 to rotatably support the crankshaft 24 at the sub-shaft section 26 thereof; wherein the crankshaft 24 has a fluid suction path 42 formed therein and opening into the lubricant oil pooling portion of the container 18; wherein the main section 27 of the crankshaft has a pair of first spiral pump grooves 43A, 43B formed in an outer surface thereof, the first spiral pump grooves 43A, 43B being fluidically

connected to the fluid suction path 42 and being functionally independent of one another; wherein the eccentric section 25 of the crankshaft 24 has a pair of vertical holes 45A, 45B formed therein, the vertical holes 45A, 45B being fluidically connected to the first spiral pump grooves 43A, 43B, respectively, and the vertical holes 45A, 45B being functionally independent of one another; wherein the sub-section 26 of the crankshaft 24 has a pair of second spiral pump grooves 48A, 48B formed in an outer surface thereof, the second spiral pump grooves 48A, 48B being functionally independent of one another and operable to pump the lubricant oil upwardly; and wherein the second spiral pump grooves 48A, 48B are fluidically connected to the vertical holes 45A, 45B, respectively, such that a first one (e.g. 45A) of the vertical holes is arranged to independently feed lubricant oil 23 from a first one (e.g. 43A) of the first spiral pump grooves to a first one (e.g. 48A) of the second spiral pump grooves, and such that a second one (e.g. 45B) of the vertical holes is arranged to independently feed lubricant oil 23 from a second one (e.g. 43B) of the first spiral pump grooves to a second one (e.g. 48B) of the second spiral pump grooves.

Thus, new independent claim 13, like independent claim 1, requires the first spiral pump grooves 43A, 43B be functionally independent of one another, and also requires the presence of two vertical holes 45A, 45B that are also functionally independent of one another. Further, like dependent claim 5, new independent claim 13 specifies the inclusion of a pair of second spiral pump grooves 48A, 48B, and that the second spiral pump grooves are functionally independent of one another.

Therefore, it is submitted that new independent claim 13 is allowable at least for the same reasons as set forth above in support of claims 1 and 5. Therefore, it is respectfully submitted that claim 13, as well as claims 14-17 which depend therefrom, are clearly allowable over the prior art of record.

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice thereof is earnestly solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, it is respectfully requested that the Examiner contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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